Ferguson, C.J., M.E. Darrach, and M.H. Mayfield. 2015. *Phlox solivagus* (Polemoniaceae), a new species from the Blue Mountains in southeastern Washington. Phytoneuron 2015-25: 1–12. Published 15 April 2015. ISSN 2153 733X

PHLOX SOLIVAGUS (POLEMONIACEAE), A NEW SPECIES FROM THE BLUE MOUNTAINS IN SOUTHEASTERN WASHINGTON

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ABSTRACT

A new species of *Phlox* is described from a series of peaks and ridgetops in the Blue Mountains of southeastern Washington state. **Phlox solivagus** M. Mayfield & M. Darrach, **sp. nov.**, is narrowly restricted to exposed rocky sites and flowers in mid–late spring when easy access by collectors can be obstructed by snow on surrounding slopes. This species is a highly distinctive caespitose perennial *Phlox* with lanate vestiture on stems and leaves, thickened leaves with involute margins (yielding a prow-shaped apex), and inflorescence herbage densely covered with gland-tipped trichomes. The new *Phlox* is described and discussed with respect to species to which it is similar, and a key to *Phlox* species of the northern Blue Mountains is provided.

Phlox is a genus of ca. 60 species chiefly occurring in North America, with a center of diversity in western North America (Wherry 1955; Locklear 2011). It is rich in species in the Pacific Northwest, particularly through the ecologically diverse area from eastern Oregon and Washington to western Montana. Near the northern terminus of the Blue Mountains in southeastern Washington and northeastern Oregon, six *Phlox* species occur that have broader distributions in the western USA: *P. douglasii* Hook. (sensu Locklear 2009; sometimes synonymized with *P. caespitosa* Nutt.), *P. hoodii* Richardson, *P. longifolia* Nutt., *P. multiflora* A. Nelson, *P. speciosa* Pursh, and *P. viscida* E.E. Nelson (which is restricted to the region; Ferguson et al., in prep. for FNANM). *Phlox colubrina* Wherry & Constance is a narrow endemic occurring slightly farther east in Hells Canyon of the Snake River and along its major tributaries.

Recent botanical explorations in the northern Blue Mountains have brought to light a new, narrowly endemic species. It appears most similar morphologically to the more open and erect *Phlox mollis* Wherry, another narrowly distributed species that occurs across the Snake River in Nez Perce County, Idaho, on and around Craig Mountain. Here we describe the new species and discuss current

knowledge of its distribution and ecology, setting the stage for further investigation of this intriguing species. Material of the new species is included in genetic research currently underway for the genus *Phlox* (CJF et al.).

PHLOX SOLIVAGUS M. Mayfield & M. Darrach, **sp. nov. TYPE: USA. Washington.** Columbia Co.: Umatilla National Forest, Griffin Peak, ca. 30 km E of Walla Walla and 27 km S of Dayton, saddle (N 46° 05.090' W 117° 54.550'), SE of peak and open summit (N 46°05.577' W 117° 54.722' to N 46° 05.638' W 117°54.752'), along seam of Columbia River Basalt, T7N R39E secs. 15 ne, 10 se, elev. 1660-1732 m, open rocky terrain on flats and slopes near ridge crest to southerly rocky precipice above talus, plants locally subdominant, stems woody, spreading in dense clumps, flowers with limbs light lavender to pinkish with contrasting darker magenta to violet throat and tube, common associates *Astragalus whitneyi, Draba densifolia, Eremogone kingii, Erigeron bloomeri, Erigeron disparipilus, Eriogonum douglasii, Lomatium cous, Lupinus lepidus, Phlox multiflora, Poa secunda, Pseudoroegneria spicata, Sedum stenopetalum,* and *Stenotus lanuginosus*, 2 Jun 2014, *M.H. Mayfield 4071* with M.W. Skinner (holotype [Fig. 1]: KSC, barcode 145557; isotypes: ID, MSC, NY, OSC, RM, US, WS, WTU, and the Umatilla National Forest Herbarium, Pendleton, Oregon). Figures 1–6.

Similar to *Phlox mollis* Wherry in the densely lanate leaves and prow-shaped leaf apices but differing notably in its more compact habit and copiously glandular calyx.

Perennial herbs forming dense mounds or tufts, with many stems spreading from a woody base, 3–7 cm. **Stems** of the season erect, with 5–7 nodes, vestiture arachnoid, vegetative stems morphologically similar to flowering stems. **Leaves** opposite, midvein abaxially prominent and adaxially visible, secondary veins not visible, narrowly lanceolate to linear, apex pungent, the longest 8–20 mm x 1–2 mm, lanate (rendering a gray-green appearance to herbage), margins thickened and involute (yielding a prow-shaped apex), marginal hairs not strongly distinct. **Flowers** usually solitary, or in a cyme of 2–3 flowers; pedicels 1–5 mm. **Calyx** campanulate, the tube with 5 thicker, green sepals joined to near the midpoint by intervening thin, translucent membranes, externally densely pubescent with the trichomes gland-tipped, with lobes internally lanate toward tips, lobes 9–14 mm, midveins discernible to near the pungent tips, membranes flat. **Corolla** funnelform with a slender tube and 5 abruptly spreading lobes, lavender pink, usually with darker purplish-magenta markings near the tube orifice, tube 11–13 (15) mm, glabrous, unconstricted, flaring slightly near orifice, the lobes 6–11 mm, obovate, apically rounded. **Stamens** unequally inserted in tube, anthers ca 1.8 mm, yellow, distal-most near orifice. **Pistil** of 3 fused carpels, the ovary with 1 ovule per locule, the style 5–7 mm, the 3 stigma branches 0.8–1.3 mm, included within the tube and among lowermost anthers. **Fruits** 3-seeded, seeds ca. 3 mm. **Phenology**: flowering mid May–early June.

Etymology. The epithet refers to the isolated, "lonely" nature of the windswept populations of *P. solivagus*. Occurrences of the species have rarely been visited by botanists during the flowering phase of the plant's phenology and thus the plants have largely escaped attention. The suggested common name is "yeti phlox," in reference to the hairy leaf vestiture.

Paratypes. **USA. Washington.** Columbia Co.: Lewis Peak, Blue Mountains, 27-29 May 1923, *Brode 14* (WS); Umatilla National Forest, Blue Mountains, SE edge of Griffin Peak, ca 19 air mi E of Walla Walla, T7N R39E S10 SE1/4, grass-forb community with *Elymus spicatus* [*Pseudoroegneria spicata*], *Festuca idahoensis*, *Poa secunda*, *Lomatium cous*, and *Sedum stenopetalum*, elev. 5650 ft, 5 Jun 2003, *Markow 12466* (KSC, topotype); Blue Mountains, summit of Squaw Peak, 1.5 air km E of Table Rock, elev. 1813 m, 46.03053°N, 117.89171°W (uncertainty: 6 m.; Datum: WGS 84; Source: GPS), windswept, treeless pinnacle with gently sloping sides, broken basalt and dry gravelly soil at summit, with low cushions of *Eriogonum ovalifolium* [*E. flavum* var. *piperi*], *Phlox* sp., *Sedum lanceolatum*, *Draba densifolia*, *Poa secunda*, and *Festuca*, leaves gray- green, with two rows of woolly-pubescence on lower surface, mostly non-glandular, plants forming loose, low mats to 40 cm in diameter from a stout taproot,

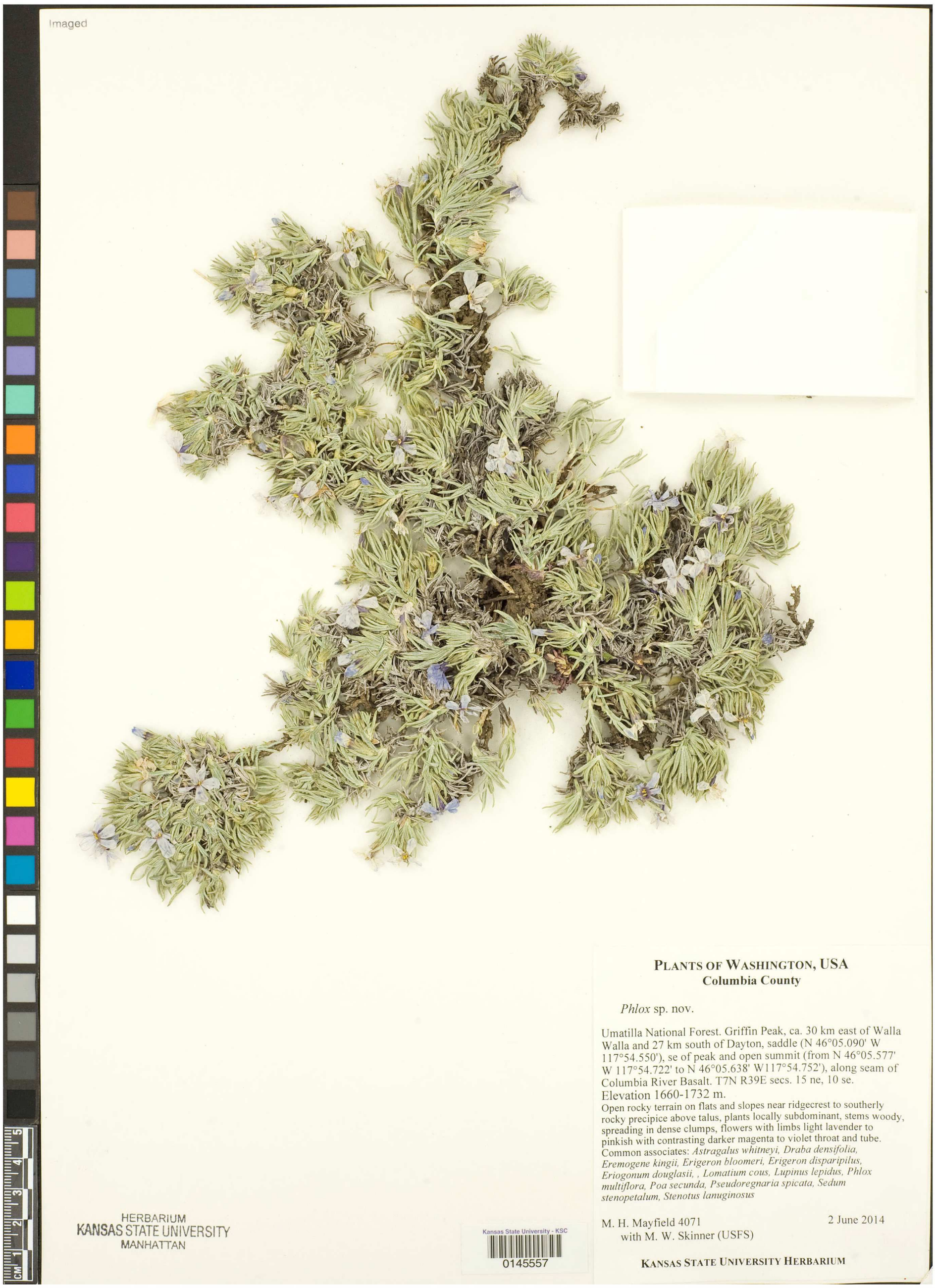

Figure 1. *Phlox solivagus* holotype (KSC).

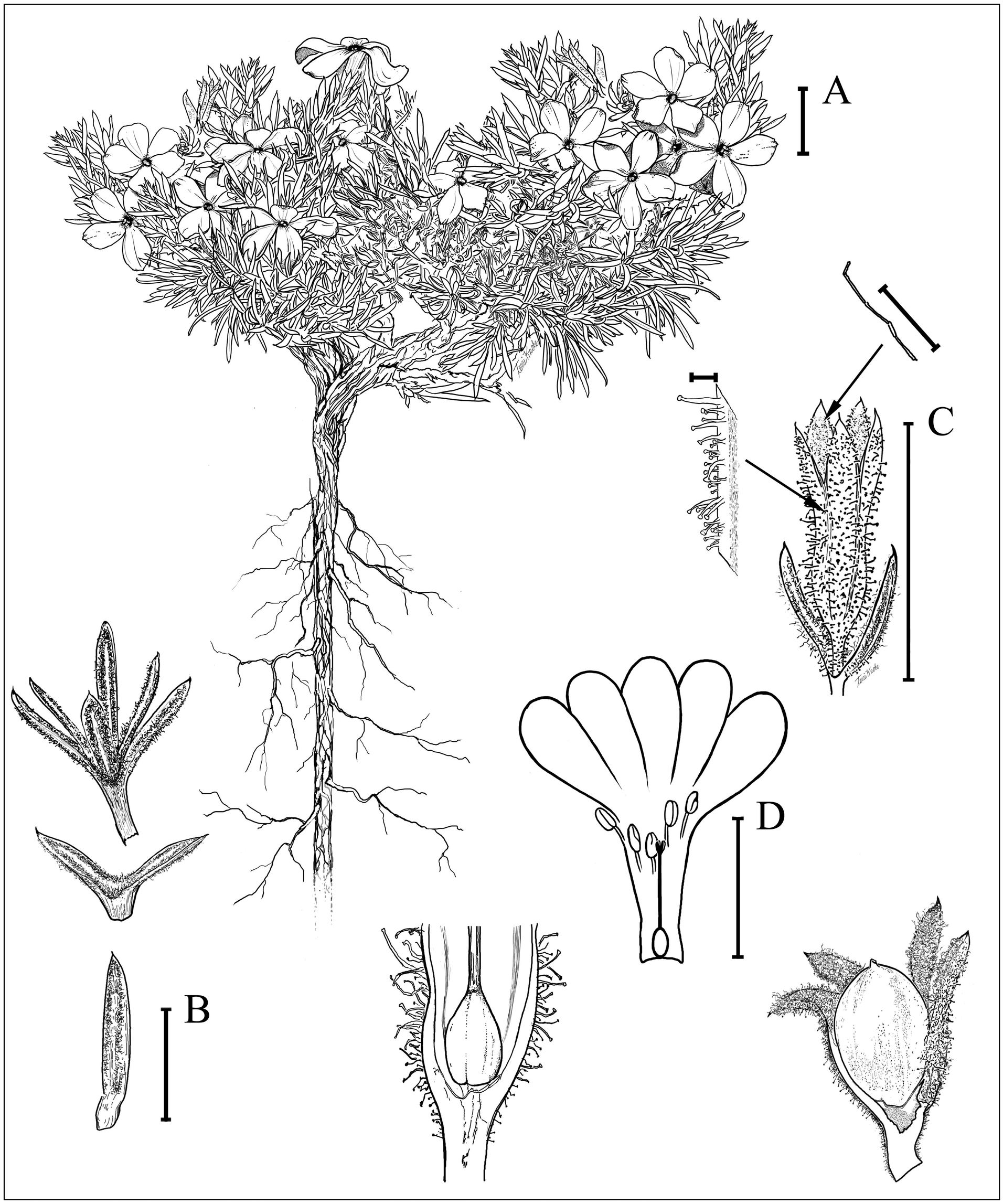

Figure 2. *Phlox solivagus* illustration. A) Habit (scale bar, 1 cm). B) Leaves, top to bottom: cluster at growing tip; pair of leaves; single leaf, adaxial view (scale bar, 10 mm). C) Calyx (scale bar, 10 mm), with detail on vestiture: left, portion of sepal, bearing gland-tipped trichomes, and part of membrane between sepals (scale bar, 1 mm); above, eglandular trichome from inner tip of sepal (scale bar, 1 mm). At bottom are shown a cutaway view of ovary in calyx (with corolla removed); and cutaway view of developing fruit (with style senesced). D) Outline view of opened corolla showing positions of reproductive parts (scale bar, 10 mm).

Figure 3. *Phlox solivagus* habit. Image was taken at the type locality, vicinity of Griffin Peak, Columbia Co., Washington. An individual of *P. multiflora*, which co-occurs at this site, is visible at top left. Image © Mark H. Mayfield.

locally abundant at immediate windswept summit where little snow appears to accumulate in winter, 5 Jul 2014, *B. Legler 13074* with S. Legler (WTU, KSC). Garfield Co.: Blue Mountains, gentle summit of Cape Horn Ridge, fairly abundant, but restricted to nearly flat aspect, elevation 4458 ft (1359 m), 46.257778°N, 117.438694°W (uncertainty: +/- 2.3 m.; datum NAD83; source: GPS), open, windswept Columbia River Basalt Group entablature surface, aspect 112°, slope 5%, associated species *Balsamorhiza serrata, Castilleja thompsonii, Lomatium piperi, Phlox hoodii, Poa secunda,* and *Pseudoroegneria spicata,* 29 Jun 2013, *Darrach 1021* with Brumbelow and Gibble (KSC); Blue Mountains, Umatilla National Forest: open rocky flat ridgetop of Cape Horn Ridge, along FS road 4106100, central part of western edge of sec 16, T9N R43E, 46°15.47' N, 117°26.32 W, elevation 4450 ft (1360 m), associated species *Allium tolmiei, Balsamorhiza serrata, Castilleja thompsonii, Erigeron disparipilus, Poa secunda,* and *Pseudoroegneria spicata,* plants scattered, common, flowers white to pale pink with darker magenta throat and tube, 28 May 2014, *Mayfield 4057* with Darrach & Brumbelow (KSC, RM, WS, WTU); Blue Mountains: gentle summit of Cape Horn Ridge, abundant, but restricted to flat aspect, elevation 4454 ft (1358 m), UTM NAD 83 11N 466181, 5122781 (+/- 2.1 m.; source: GPS), aspect flat, substrate basalt lithosol, associated species *Allium tolmiei, Balsamorhiza serrata, Castilleja thompsonii, Erigeron disparipilus, Penstemon humilis, Poa secunda, Pseudoroegneria spicata,* 28 May 2014, *Darrach 1059* with Mayfield & Brumbelow (Umatilla National Forest Herbarium, Pendleton, Oregon).

Figure 4. Habitat of the new species on rocky, sparsely vegetated slopes at the type locality on the north side of Griffin Peak (Columbia Co., Washington). Flowering individuals of *P. solivagus* (lavender pink corollas, gray-green herbage) are visible throughout the image (with one plant obvious in the lower right quadrant of the image; some individuals of *P. multiflora* [white corollas, green herbage] are also visible in this area). Image © Mark H. Mayfield.

Figure 5. Flowering stems of *P. solivagus* (note that numerous other taxa are visible in the image). Image was taken at the Cape Horn Ridge site, Garfield Co., Washington. Image © Mark H. Mayfield.

Figure 6. *Phlox solivagus* individual with senescing flowers and developing fruits (Cape Horn Ridge, Garfield Co., Washington). Image © Mark H. Mayfield.

Distribution and ecology

Phlox solivagus has been most recently documented from three populations in the northern Blue Mountains of Washington state: Griffin and Squaw Peaks in Columbia County, and Cape Horn Ridge in Garfield County. The Lewis Peak locality represented by the paratype collection of M.D. Brode from 1923 has not, to date, been revisited by the authors, and it is not known if the population is still extant. It is not clear from the original label data whether the collection was made on what is now private, possibly developed land, or Bureau of Land Management (BLM) property.

The locations of the type collection at Griffin Peak and the paratype collection from Squaw Peak are quite close to the Oregon state border. Potentially suitable habitat occurs over the state line in Oregon and searches throughout the area should be conducted to ascertain possible presence.

There are possibly additional sites that harbor *Phlox solivagus* in similar habitats in the northern Blue Mountains of Washington. However, we do not expect the species to be found in great abundance beyond the already known localities. Workers on the Umatilla National Forest have historically paid close attention to plant diversity and are well aware of the heterogeneous habitats of the region. Given this and the distinctive appearance of *P. solivagus* at all times during the field season (whether reproductive or not), recent observations by Forest Service workers with knowledge of the new species have not turned up additional sites. All of the recently documented populations (all populations except that represented by the historical Lewis Peak collection) are on public lands of the Umatilla National Forest, and future survey efforts should focus intensively on sites within the forest boundaries — although searching for populations on adjacent private and BLM land holdings will also be necessary in order to fully ascertain the distribution of the species.

Phlox solivagus occurs in discrete clumps or as isolated individuals that tend to be a subdominant element of the associated immediate plant community. Locally, for example in the Squaw Peak population, *P. solivagus* can be a dominant species from a percent cover standpoint. Studies at the Griffin Peak population estimate densities of 1.8 plants per m^2 (over a total of 98 contiguous plots evaluated; MED, unpubl. data). In the area of Cape Horn Ridge, plants are observed to occur beyond the primary collection site on three nearby ridges (with some discontinuity; MED, unpubl. data; this site is hereafter referred to as a metapopulation). The sum total number of individuals occurring at the Griffin Peak, Squaw Peak and the Cape Horn Ridge sites is estimated at 2000–3000 individuals. Careful observations by several botanists to date indicate that these populations may be in decline: most individuals in all populations are observed to be mature and many are clearly senescing, while plants interpreted as younger are either not evident or very uncommon.

Conservation measures that should be considered for *Phlox solivagus* include a long-term trend monitoring program and in particular a concerted effort to search for additional populations. In this regard a sense of how broadly the species may be distributed is of value. The Griffin Peak population and the Cape Horn Ridge metapopulation are separated from each other by approximately 45 air kilometers. This distance also encompasses a precipitation gradient that declines northeastward from a 30-year moving average of 142–152 water equivalent cm per year at Griffin Peak to approximately 51–71 water equivalent cm per year at Cape Horn Ridge and adjacent xeric ridge systems. This broad gradient suggests that *P. solivagus* may have a similarly broad ecological amplitude and may therefore potentially occupy a sizeable geographical area where appropriate flat to gently-sloping exposed rocky habitats exist.

Phlox solivagus appears to be restricted to erosional paleosurfaces that include what are interpreted to be modified Pleistocene remnant plant communities — this may be particularly informative to the search for additional populations. All of the known occurrences, and in particular

those sites in the Cape Horn Ridge metapopulation, are clearly restricted to a flat to very gently easterly aspect, regionally-extensive erosional paleosurface. These surfaces are typically very limited in areal extent and may serve as refugia that support a unique relict plant community apparently found nowhere else in an otherwise highly dissected, erosionally active landscape. At the type locality and the nearby Squaw Peak population, elements of the plant community also suggest a highly modified low alpine vegetation zone influence, with alpine lichen taxa such as *Ochrolechia upsaliensis* being present. This observation is in concordance with vegetation patterns observed elsewhere in the general area. Plants of *P. solivagus* are almost completely absent on the erosionally active landforms adjacent to the gentle paleosurface sites.

Species documented to co-occur with *Phlox solivagus* include *Allium tolmiei*, *Astragalus whitneyi*, *Boechera sparsiflora*, *Balsamorhiza serrata*, *Castilleja thompsonii*, *Draba densifolia*, *Draba verna*, *Elymus elymoides*, *Epilobium brachycarpum*, *Eremegone kingii* var. *glabrescens*, *Erigeron bloomeri*, *Erigeron disparipilus*, *Eriogonum douglasii* var. *douglasii*, *Eriogonum flavum* var. *piperi*, *Eriogonum heracleoides*, *Eriogonum umbellatum* var. *ellipticum*, *Festuca idahoensis*, *Lomatium cous*, *Lomatium macrocarpum*, *Lupinus lepidus* subsp. *aridus*, *Lupinus sulphureus*, *Microsteris gracilis*, *Ochrolechia upsaliensis*, *Olysnium douglasii* var. *inflatum*, *Penstemon humilis*, *Penstemon pennellianus*, *Penstemon venustus*, *Phlox hoodii*, *Phlox multiflora*, *Poa secunda* subsp. *secunda*, *Pseudoroegneria spicata* var. *spicata*, *Pyrrocoma carthamoides*, *Sedum stenopetalum*, *Selaginella wallacei*, *Silene douglasii*, and *Stenotus lanuginosus*.

Discussion

Material of the new species was first brought to the attention of the first author by Stuart Markow, a Forest Service botanist serving on the Umatilla National Forest in the early 2000s. Markow observed the Griffin Peak population (now the type locality), collected a specimen and sent it to CJF, who had not encountered similar material from the Blue Mountains during studies of *Phlox*. CJF and MHM, in work on the *Phlox* treatment for the *Flora of North American North of Mexico*, had noted similarity of the Markow specimen to *P. mollis* (discussed below) and filed the unicate specimen as "aff. *P. mollis*" pending further study. The second author, MED, discovered the Cape Horn Ridge metapopulation on 29 June 2013 and recognized the plants as unusual (despite their being past flower). He collected material and sent it to CJF. This latter discovery matched the Markow specimen and underscored the unique morphology of these populations, spurring June 2014 field research by MED and MHM along with USDA Forest Service Regional Botanist Mark Skinner. MHM additionally located an historical specimen, *Brode 14* (WS, collected in 1923). Interestingly, this latter specimen had been annotated in the 1940s as a possible new taxon by Edgar T. Wherry, the most recent monographer of *Phlox*, although he did not describe it nor explicitly discuss the specimen in his treatment of the genus (Wherry 1955). Botanist B. Legler (University of Washington, Burke Museum [WTU]) discovered the Squaw Peak population in July 2014 and Forest Service personnel have continued to seek out additional occurrences of the new species.

Early in our study, the very dense, woolly vestiture of *Phlox solivagus* suggested an evolutionary affinity with *P. mollis*, a narrowly endemic taxon occurring some 50 km to the east-southeast, across the Snake River in western Idaho. However, whereas the inflorescence of *P. solivagus* bears glandular trichomes, *P. mollis* lacks glandular hairs entirely. Moreover, *P. mollis* differs in its upright (vs. mounded) habit with taller stems and well-spaced nodes and in its larger leaves and larger floral measurements. In fact, *P. mollis* is similar in habit to upright western taxa including *P. longifolia* Nutt. and *P. viscida* E.E. Nelson. Interestingly, Wherry (1955) noted *P. mollis* as "reported from Blue Mts.," suggesting either that he equated the new species with *P. mollis* based on the material he had previously observed, or perhaps he had communication with botanists in the area and assumed the material to be conspecific with *P. mollis* based on descriptions, possibly of the

striking vestiture. The historical paucity of herbarium specimens of *P. solivagus* clearly hindered an understanding of diversity of *Phlox* in the region.

Phlox solivagus is readily differentiated from other caespitose *Phlox* of the area by its leaves with copious, lanate vestiture and distinctly thickened margins, along with glandular vestiture limited to the inflorescence (calyx, pedicels, and bracts subtending flowers). It co-occurs at Griffin Peak with *P. multiflora*, which can be differentiated by its glabrescent leaves and inflorescence herbage that is glabrescent or with sparse, eglandular trichomes (among other characteristics). *Phlox solivagus* co-occurs at Cape Horn Ridge with *P. hoodii*, which has leaves with sparse, eglandular vestiture, and inflorescence herbage with sparse, long, eglandular vestiture (becoming lanate inside calyx lobes). *Phlox douglasii* occurs near the Griffin Peak population and, like *P. solivagus*, has gland-tipped trichomes throughout the inflorescence; throughout the plant, however, its leaves bear gland-tipped trichomes — the vestiture is not lanate. In the vicinity of Griffin Peak, both *P. multiflora* and *P. douglasii* begin to flower when *P. solivagus* is past its peak flowering time. At Cape Horn Ridge, *P. hoodii* flowers at the same time or somewhat before *P. solivagus*, but its flowers are much smaller and white to blue lavender. While flower color is not normally a good taxonomic character in *Phlox*, it may be somewhat useful in the Blue Mountains: all populations of *P. solivagus* observed consistently exhibit lavender pink corollas, while co-occurring *P. multiflora*, like *P. hoodii*, is white to pale blue lavender (Figs. 3, 4). Both *P. longifolia* and *P. viscida* occur in the Blue Mountains (the former being common at lower elevations and the latter occurring on relatively mesic slopes in the arid eastern portion of the area up into the mountains in canyons), and each of these has a more upright growth habit, typically with many-flowered inflorescences. Finally, *P. speciosa* occurs in the broader region surrounding the northern Blue Mountains; it also exhibits a tall, open growth habit and is most easily differentiated from other upright *Phlox* in the area by its notched petals and very short style (positioned deep in the corolla tube, well below all of the anthers). A key to *Phlox* species occurring in the northern Blue Mountains is provided below.

Key to *Phlox* of the northern Blue Mountains

1. Plants tall, with an open, upright habit (usually much more than 1.5 dm tall), with several to many erect to decumbent-ascending stems arising from an openly branched woody base; flowering stems elongating, rising to well above the sterile stems (when the latter are present); flowers in cymose inflorescences with 3–many flowers; plants occurring in grasslands and canyons, common at lower elevations in the northern Blue Mountains or on mesic canyon slopes within arid areas at higher elevation.

    2. Stems typically with many short axillary shoots; the longest leaves 50–80 mm; inflorescence herbage densely glandular pubescent; the membranes between calyx lobes sunken to flat (or slightly plicate but never protruding toward the base) ..... **Phlox viscida**
    2. Stems typically without axillary shoots; the longest leaves 25–45 mm; inflorescence herbage glabrous to eglandular or glandular pubescent; the membrane between calyx lobes distinctly plicate and bulging (saccate) toward the base ..... **Phlox longifolia**

1. Plants low, compact to loose spreading tufts or mounds (mostly less than 1 dm tall), with many stems spreading from a closely branching, woody base; flowering stems positioned among leafy stems (when the latter are present); flowers solitary and terminal or in cymose inflorescences with 2–3 flowers; plants occurring on open flats and slopes, chiefly at higher elevations in the northern Blue Mountains.

    3. Calyx with gland-tipped trichomes; corollas shades of pink (within the area; *P. douglasii* sometimes white elsewhere).

4. Leaves gray-green, dull, densely lanate on both surfaces, the margins thickened and involute towards the apex, the longest 8–20 mm in length; calyx with gland-tipped hairs externally, but with woolly, eglandular hairs (lanate) internally toward the lobe tips; corollas larger, the lobes mostly 8–10 mm in length ..... **Phlox solivagus**
4. Leaves dark green, lustrous, glabrescent to sparsely glandular pilose, the margins not thickened, the longest 7–12 mm in length; calyx with gland-tipped hairs externally, the lobes glabrescent or with sparse, gland-tipped hairs internally; corollas smaller, the lobes mostly 5–8 mm in length ..... **Phlox douglasii**

3. Calyx glabrous, or with eglandular trichomes; corollas white to pale blue lavender (within the area).

5. Stems with the distal internodes mostly concealed by the leaves, usually with arachnoid woolly pubescence; longest leaves 6–12 mm in length; inflorescence herbage densely to sparsely lanate, especially near the sepal bases; the membranes between calyx lobes flat to slightly keeled ..... **Phlox hoodii**
5. Stems with the distal internodes readily visible, glabrous or with short patent hairs; longest leaves 11–35 mm in length; inflorescence herbage glabrous (within the area); the membranes between the calyx lobes flat to sunken ..... **Phlox multiflora**

It is remarkable that such a distinctive and showy species occurring on public lands could be, until very recently, largely unnoticed and so rarely collected by botanists. While parts of the Blue Mountains of Oregon and southeast Washington are rather remote and difficult to access, two of the presently known populations of *Phlox solivagus* are readily accessed via the local Forest Service road system (the population at Griffin Peak is at the site of a former fire observation station!). However, the new species flowers very early within the area — in its exposed habitat, *P. solivagus* flowers in mid-May and early June, when easy routes to the Griffin and Squaw Peak sites in particular are typically restricted by snow. Botanists visiting the area later in the year are unlikely to pay much notice to material with senesced infructescences — thus, a lack of collections. Even so, the species is easily identifiable any time of the year when snow is absent, and agency botanists conducting surveys would likely have noted the distinct character of the plant in the past had it been encountered.

Authors have noted both the ongoing discovery of new plant taxa in North America (e.g., Ertter 2000, Hartman & Nelson 1998) and the importance of continued collecting efforts (e.g., Prather et al. 2005a, 2005b). Indeed, undescribed vascular plant taxa in the Blue Mountains region are being discovered on a regular basis (e.g., Darrach & Wagner 2011, Darrach & Hinchliff 2014, MED pers. comm.). Our study highlights the importance of focused botanical collecting with regard to "holes" in specimen holdings and, in this case, a possible "hole" with respect to phenology in an area (rather than a simple case of limited collecting in a geographical area). We hope that the present study spurs not only detailed research on *P. solivagus* but increased botanical interest in the clearly undercollected Blue Mountains region in general.

ACKNOWLEDGEMENTS

The illustrations were graciously provided by Terri Knoke. We thank USDA Forest Service Region 6 personnel for assistance with permitting and are particularly grateful to Alan Ager, Tom Brumbelow, Joan Frazee, Terri Knoke, and Mark Skinner for logistical support. Thanks to Mercedes Santiago and Kate Waselkov for reading the manuscript; and much appreciation to Guy Nesom for editorial work and review and to Bob Patterson for review. We acknowledge support from NSF DEB-1258167 and the Kansas Agricultural Experiment Station (contribution no. 15-351-J).

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